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ORIGINAL PAPER

The perceived benefits of the European Union standardization. An exploration according to firm size and firm capabilities

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Abstract We examine how the European Union (EU) standardization policy is perceived by firms by exploiting a survey dataset on firms' benefits. We explore whether perceived benefits are associated with firm size and firm capabilities. We find strong evidence that the perceived benefits of standardization is not equally distributed across firm size classes, industries and countries. Our study indicates that small ventures are less likely to perceive benefits from EU standardization than their larger counterparts, in particular in Eastern European and Mediterranean countries. Additionally, we find evidence that firms with the capabilities to be innovative, exporting and that employ

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foreign labor are more likely to perceive benefits from standardization than their non–innovative, non–exporting and non–foreign labour–employing counterparts. We suggest EU and EU Member States, in particular in Eastern and Mediterranean Europe, to focus on facilitating standardization compliance by enhancing the critical firm capabilities identified. Stimulation efforts could also be considered to address simultaneously supporting capabilities and standardization literacy.

Keywords European standardization · Firm size · Firm capabilities · Country effect

JEL classification (L15) Information and Product Quality; Standardization and Compatibility · (L25) Firm Performance: Size · Diversification · and Scope · (F15) Economic Integration

1 Introduction

Technical standardization is a key pillar of the free common market program in the European Union (Pelkmans 1987). It addresses non-discriminatory barriers to trade (Nicolaïdis and Egan 2001) and creates a level playing field (den Butter and Hudson 2009), with all firms being subject to the same laws and regulations. However, it does not guarantee that all firms have the same opportunities to succeed. The European Commission recently suggested that smaller firms might face specific barriers (European Commission 2006; de Vries et al. 2009): less awareness of standardization processes and their impact and a lack of firm-level strategic resources which are required to invest in and benefit from standardization. Similarly, firms lacking the necessary absorptive capacity (Zahra and George 2002; Cohen and Levinthal 1990) to adopt new or alternative technologies may have a harder time adapting to EU standardization. In contrast, enterprises with an international workforce, export experience or innovation capabilities might be better equipped to adapt to standardization because of built–up experience and flexible organizational cultures (Radosevic 2004). Recent calls have been made for micro-level research on the way standardization affect firms (European Commission 2006; de Vries et al. 2009) yet those are still scarce. By far the majority of studies focus on the macro–level impact at the European level, and to a lesser extent at the national level (Knill and Lehmkuhl 2002). The current study complements this literature by examining whether perceived benefits are associated with firm size and firm capabilities across different sectors and European regions. We explore a number of firm–level factors that may be linked to the perceived relative benefit or cost of complying with the EU *vis–à–vis* national standards. Specifically, we focus on firm size and firm capabilities, particularly innovation performance, export

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experience and international workforce. To this end, we employ data from the *Observatory of European Small and Medium Sized Enterprises* (SMEs) 2006/7 survey, in which responses from more than 17,000 firms in 30 European countries are reported. Moreover, with these data, we can identify the self–perceived differential effect of standardization across industries and regions: i.e., Anglo–Saxon, Continental European, Eastern European, Mediterranean and Scandinavian/Nordic countries. To the best of our knowledge, this has not yet been investigated, to date.

We offer three contributions. First, as far as we know, ours is the first study that examines the perceived benefits of EU standardization at the firm level, focusing on the possible effect of firm size and firm capabilities. In so doing, we explore the extent to which these factors might facilitate enterprises to reap benefits from EU standardization. Second, our data cover a wide variety of sectors in a large set of European countries, which offers the opportunity to explore whether firm perceptions of the EU standardization differ across geographic and industry sub–groups. Third, because we employ business leaders' opinions to examine the firm–level benefits of standardization, we are able to break away from the commonly used objective but aggregate quantitative measures.

The focus on business leaders' opinions is relevant for the following reason. First, standardization is a multifaceted phenomenon, and its effects are often related to a wide variety of organizational aspects, such as strategy implementation and technological progress. Evaluating the compliance costs and the benefits of standards has, to some extent, an arbitrary character. It requires a good insight into the management of the firm (den Butter and Hudson 2009), which is typically gained by business leaders (Wall et al. 2004). They have experience with and knowledge of the implementation of standardization. Their cognitive judgments provide valuable information concerning the likely firm–level impact of standardization. Furthermore, business leaders make decision based on the perceived desirability of the standardization process. This is why, we believe, our focus on the perceived firm–level impact of EU standardization adds to the current state of the art.

2 Theoretical framework and hypothesis development

There are three types of standardization (David 1987): reference (e.g., measures for weight, height or size, and other dimensions of material measurements), minimal admissible attributes (e.g., product quality and safety levels), and product compatibility standardization. Reference standardization is already well established within the EU, forming the basis for minimal admissible attributes and product compatibility standardization. Studying reference standardization is therefore of limited interest because consensus has been reached and because such standards are unlikely to have much impact on firm functioning. In contrast, admissible attributes and product compatibility standardization are both expected to highly influence the way enterprises operate. Therefore, in what follows, we focus on these two standardization types.

Minimal admissible attributes standardization aims to protect consumers from dysfunctional or unsafe products. Jones and Hudson (1996) argue that this type of standardization reduces consumer searching costs by lowering the uncertainty

associated with assessing product quality. Through such standardization, the variation of product quality decreases and minimum quality standards are reached. However, the impact on total welfare is ambiguous. At the macro level, negative consequences for welfare include the decrease of variety available in the market place when firms that do not comply with the set standard are pushed out of the market (Farrell and Saloner 1986). At the firm level, firms originally producing lower quality products are obliged to make investments in order to meet minimal admissible attributes standards. This often times turns out to be relatively costly, especially for small enterprises. The effect of admissible attributes standards on average production costs is thus higher for smaller firms because of economies of scale disadvantages. Contrary to small ventures, large enterprises are able to ascribe the additional standardization adoption costs to large production volumes. Thus, we expect that large firms benefit more from admissible attributes standardization than their small competitors.

Product compatibility standardization aims to stimulate competition and integration within a common market. Product compatibility is useful because consumers can enjoy network externalities (or demand–side scale advantages) as the number of consumers increases (Shy 2011; Katz and Shapiro 1985; Farrell and Saloner 1985). Likewise, product compatibilities can be beneficial for the firm. Matutes and Regibeau (1996) suggest that the amplitude of a firm's incentives to pursue product compatibilities mainly depends upon the difference between the adoption cost to produce the compatible products, on the one hand, and the capacity of the firm to secure market opportunities and thus profit from selling compatible products, on the other hand. Producing compatible products (or complying with a newly–set standard) implies costs for the firm – i.e., investments in machineries, technologies, production processes or costs of organizational restructuring (involving, e.g., hiring new human capital). If the cost of standardization is smaller than the expected profit increase, compatibility is beneficial for the firm; if the cost of producing compatible products is higher than the expected profit increase, compatibility is undesirable, and will probably never be achieved (Antonelli 1994).

Similar to the case of minimal admissible attributes standardization, we expect that compliance cost for compatibility standardization (that is, investments for producing compatible products) can affect firms differently, depending upon the firm's size (Nijsen et al. 2009). For instance, large enterprises might benefit from economies of scale, and therefore will be less affected by internal compliance costs in comparison to small enterprises. Since production volumes of large firms are higher than those of their smaller counterparts, the average additional (overhead) cost per unit will be lower for larger ventures. Indeed, Dobrev and Carroll (2003) list several mechanisms that enable large firms to generate efficiency gains: for example, equipment and labour specialization, subsequent experiential learning, low per unit overhead costs, and savings from operational and capacity expansions.

Additionally, we expect that large enterprises might be better equipped to engage in lobbying activities than their small counterparts (Bouwen 2002). Because of relatively high bargaining power, large enterprises might be able to influence the standardization process for compliance up–front (Gehring and Kerler 2008; Farrell and Saloner 1985). In this way, they can lobby for compatibility with their existing production processes, which will lower their own compliance costs. Large firms might thus be better able than their small counterparts to ensure that the standards are beneficial for them. Moreover, they can use the new standard as a strategy to predate fringe firms by forcing rivals to

compete at higher cost (Salop and Scheffmanm 1983). Indeed, the standard-setting process can be used as a competitive tool rather than as a means of expanding networks and markets internationally (Austin and Milner 2001). In such cases, standardization is very likely to become detrimental for small firms, forcing them to sell products at even higher prices.

Finally, large companies might be better equipped to adapt to EU standards than their small counterparts. Large firms usually have deeper financial pockets and more technological resources. They enjoy scale advantages and they have a wider activity portfolio (Nooteboom et al. 2007). This allows them to more easily find a fit with newly–set standards. As a result, such standards can offer new market opportunities. In addition, large enterprises face fewer capacity constraints than small ventures in gaining benefits from the market size expansion that results from EU standardization efforts. Given that average additional costs and capacity constraints are lower for a large firm, we argue that larger companies gain more from EU standardization. Keeping in mind that we have access to firm self-reported benefit, the above discussion leads to:

Hypothesis 1 (H1). The perceived benefit from EU standardization is positively associated with firm size.

As explained above, standardization creates product compatibility and market integration, which together result in new opportunities for firms that want to expand their market coverage (Cao and Prakash 2011). Moreover, such integrated markets are often much more competitive after standardization programs are implemented. Interestingly, only companies with sufficient capabilities to realize these opportunities are able to thrive in highly competitive markets with ample market opportunities. In what follows, we list a number of firm characteristics that might influence such capabilities.

First, we expect that innovative firms are able to reap greater benefits from standardization. Coad and Rao (2008) show that innovation is of great importance for firm growth, indicating that such innovative ventures are better able to capture new market opportunities than their non–innovative counterparts. In Schumpeter's terminology, innovation can be a trigger of a process of creative destruction. Innovation is a major source of firm growth by allowing companies to optimally exploit their resources through new technologies. This might explain why firms active in the same market tend to differ considerably (Nelson 1991). Such differences in innovative capabilities are especially relevant in the European Union. The European Commission has identified innovative capabilities as essential to withstand competitive single market pressures (Radosevic 2004). Moreover, innovative capabilities can result in higher market opportunity exploitation and lower compliance cost because of enhanced absorptive capacity (Cohen and Levinthal 1990; Zahra and George 2002), which is "a set of organizational routines and processes by which firms acquire, assimilate, transforms and exploit knowledge to produce a dynamic organizational capability" (Zahra and George 2002: 186).

Another firm characteristic that might impact the ability to benefit from standardization relates to exporting activities. Standardization lowers international entry barriers between countries, and promotes international trade volumes between countries involved in the standardization program (Blind 2001). There are at least two important reasons as to why exporting enterprises may gain more from EU standardization than

non–exporting firms (Burpitt and Rondinelli 1998; Bernard and Wagner 1997; Bonaccorsi 1992). The first reason is that exporting companies have higher learning capabilities. They are experienced in dealing with foreign markets, which makes them better equipped to capture new business opportunities abroad. The second reason is that exporting firms may well enjoy greater economies of scale advantages because they often serve large markets. As a result, they tend to be more competitive than domestically oriented ventures. Hence, standardization increases the exportability of products, which, in turn, facilitates economies of scale (den Butter and Hudson 2009).

A third and final firm characteristic that may positively affect the benefit from standardization is the employment of foreign labour, either as a result of strategic choice or because of foreign ownership of the firm. Having access to human capital from different countries can play a key role in exploiting opportunities from the single market (Archibugi and Coco 2005). By employing a workforce already accustomed to the newly–set standards, the company may reduce compliance cost. This is particularly relevant when EU standards differ from national regulations, implying that in–depth insights into these differences are necessary. Thus, we expect that employing foreign labour enhances the ability of an employer to cope with EU standardization; especially if these new standards differ greatly from their prior national counterparts. How much the firm is innovating, exporting and employing foreign labour may affect the perceived benefit of standardization. The other way around is however possible as well, with perceptions about standardization benefit being linked to the firm effort into innovation and export, and foreign labour employment.

Hypothesis 2 (H2): The perceived benefit from EU standardization is larger for (a) innovative, (b) exporting, and (c) foreign labour–employing enterprises.

3 Data and measures

We utilize a dataset of the *Observatory of European Small and Medium Sized Enterprises 2006/7* (OE–SME) for which a survey was carried out between November and December 2006 across the then 27 Member States of the European Union, plus Norway, Iceland, and Turkey. The main purpose of the survey was to collect information about general firm characteristics, business constraint perceptions, issues of competition, human resource bottlenecks, internationalization, and innovation. The respondents of the survey were business leaders responsible for strategic decision–making, most being general managers, owners or financial directors. A total of 17,283 enterprises were interviewed, of which 16,339 are small and medium–sized enterprises. The sample is drawn from all firms active in the countries surveyed, in all industries, through a stratified random sampling technique in which the sample is selected randomly based on each country's industry and firm size (number of employees) categories.

The *dependent variable* of our study is the declarative assessment of the business leader concerning the benefits of standardization in Europe. Our dependent variable (coined *Standardization Benefit*) is the following survey item: "Nowadays, technical standards and certain regulations are often decided at the EU level to avoid trade barriers. Do you see any benefit for your enterprise that EU standards replace national

regulations, or not?" The possible answers to this question are "No", "It depends" and "Yes", which we coded as −1, 0 and +1, respectively.

The *independent variables* are *Firm Size, Innovation Turnover, Export Share* and employing *Foreign Labor*. *Firm Size* is defined as the established classification of the firm category as used by the European Commission: i.e., *Micro–Sized Firm* for enterprises that have 9 or fewer employees, *Small–Sized Firm* for 10–49 employees, *Medium–Sized Firm* for 50–249 employees, and *Large–Sized Firm* for more than 250 employees. For *Innovation Turnover*, we use the following survey item: "Could you please estimate the percentage of turnover (annual sales) coming from new or significantly improved products or services in the last two years" The answer to this question ranges between 0 and 100%. *Export Share* is defined as the share of export compared to the firm's total sales in 2005. For *Foreign Labour*, we calculate the firm's share of employees coming from other countries compared to the venture's total number of employees.

Furthermore, we include *Firm Growth* as a control variable in order to avoid omitted variable bias issues. In this way, we seek to control for potential biases in the self–evaluation of the business leaders, isolating the latter from the effect of their firms' growth in the previous years. *Firm Growth* is defined as the increase in the ventures' number of employees from 2005 to 2006 divided by their number of employees in 2005. In addition, we add industry and country dummy variables to control for heterogeneity at the level of both industries and countries.

4 Empirical findings and discussion

Table 1 provides descriptive statistics and bivariate correlation coefficients. Our final sample consists of 14,964 firms: 9525 (63.70%) micro; 2807 (18.80%) small; 2130 (14.20%) medium; and 502 (3.40%) large–sized enterprises. The average sample size per country is 499 firms, with the smallest sample (254 ventures) in Luxemburg and the largest (888 companies) in Romania. As to the response of the business leaders to the question whether or not EU standardization benefits their enterprise, compared to prior national regulations, the total number of respondents is 13,612, with those answering "Yes" representing 34.3, "It depends" 10.4, and "No" 46.3%. Our empirical results per industry are provided in Table 2 and in Table 3 per country region – i.e., Continental European, Eastern European, Scandinavian, Mediterranean and Anglo–Saxon countries. Note that since the nature of our dependent variable is an ordinal scale, we ran *ordered logistic regressions* to estimate our empirical model specifications.

The regression results, after controlling for country and industry–level heterogeneity, in the base model show that the perceived benefits of standardization are smaller for smaller ventures. The regression coefficient for *Medium–Sized Firm* is −0.365 ($z < 0.05$), for *Small–Sized Firm* − 0.640 ($z < 0.01$) and for *Micro–Sized Firm* − 0.648 ($z < 0.01$), with *Large–Sized Firm* serving as the benchmark category. This result gives initial evidence supporting *Hypothesis 1*. Note that the smaller perceived benefits for small firms are not an indication that small ventures always accrue negative or positive (absolute) benefits, as our coefficients reflect the relative effect vis–à–vis the benchmark category of large enterprises. It may, for example, be the case that small firms perceive negative benefits and large companies positive gains.

Table 1 Descriptive statistics and bivariate correlations

#	Variable	Mean	S.D.	Min	Max	1.	2.	3.	4.	5.	6.	7.	8.
1.	Standardization Benefit	−0.13	0.93	−1.00	1.00								
2.	Large–Sized Firm	0.03	0.18	0.00	1.00	0.06							
3.	Medium–Sized Firm	0.14	0.35	0.00	1.00	0.05	−0.08						
4.	Small–Sized Firm	0.19	0.39	0.00	1.00	−0.03	−0.10	−0.22					
5.	Micro–Sized Firm	0.64	0.48	0.00	1.00	−0.04	−0.24	−0.54	−0.62				
6.	Innovation Turnover	13.16	21.21	0.00	100.00	0.11	0.00	0.00	0.00	−0.01			
7.	Export Share	5.19	17.89	0.00	100.00	0.11	0.12	0.17	0.02	−0.19	0.10		
8.	Foreign Labor	2.98	11.94	0.00	100.00	0.03	0.00	0.01	0.05	−0.05	−0.02	0.05	
9.	Firm Growth	0.10	1.31	−0.99	64.00	0.02	−0.01	−0.01	−0.02	0.03	0.04	0.00	0.02

S.D. = Standard deviation; Min = Minimum value; and Max = Maximum Value

Table 2 Ordered logistic regression results per industry

	All		Manufacturing		Construction		Wholesale & retail		Hotel & restaurant	
	Coef.	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*
Variables of interest:										
Firm Size:										
Medium–Sized Firm	−0.365**	−2.55	−0.098	−0.38	−0.821*	−1.89	−0.430	−1.09	0.681	1.03
Small–Sized Firm	−0.640***	−4.52	−0.111	−0.42	−1.581**	−3.70	−0.699*	−1.81	−0.073	−0.12
Micro–Sized Firm	−0.648***	−4.78	−0.470*	−1.77	−1.256**	−3.06	−0.837**	−2.24	−0.107	−0.18
Innovation Turnover	0.008***	6.68	0.005**	1.96	0.009**	2.27	0.011***	4.16	−0.004	−0.70
Export Share	0.008***	6.32	0.008***	3.61	0.011*	1.70	0.009***	3.14	0.026*	1.93
Foreign Labour	0.009***	3.27	0.013*	1.74	0.006	1.02	0.015**	2.16	0.014**	2.12
Control variables:										
Firm Growth	0.018	0.87	−0.033	−0.43	0.421***	2.56	−0.095	−1.22	0.090	0.55
Country Dummy	Yes		Yes		Yes		Yes		Yes	
Sector Dummy			–		–		–		–	
• Construction	−.035	−0.40								
• Wholesale & retail	.096	1.21								
• Hotel & restaurant	−.205*	−1.90								
• Transp, stor & comm	−.050	−0.45								
• Financial intermed	−.091	−0.76								
• Real est., renting & buss activities	.061	0.70								
• Health & soc. works	−.051	−0.41								
• Other community, soc. & personal serv.	−.182	−1.41								
Log likelihood	−6241		−1155		−874		−1357		−437	
# of obs.	6893		1279		988		1507		544	

Table 2 (continued)

	All		Manufacturing		Construction		Wholesale & retail		Hotel & restaurant	
	Coef.	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*
LR Chi2	814.16		174		184		172		103	
Prob > Chi^2	0.00		0.00		0.00		0.00		0.00	
Pseudo R^2	0.06		0.07		0.09		0.06		0.11	

	Trans, storage & comm		Financial int.		Real est., rent & buss activ.		Health & soc. works		Other comm, soc. & pers. serv	
	Coef.	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*
Variables of interest:										
Firm Size:										
Medium–Sized Firm	0.384	0.80	0.117	0.18	−0.605	−1.44	−1.147	−1.49	−2.325***	−2.72
Small–Sized Firm	−0.327	−0.67	−1.007	−1.48	−0.801*	−1.94	−1.327	−1.62	−1.827**	−2.15
Micro–Sized Firm	−0.168	−0.38	−0.571	−0.99	−0.504	−1.30	−1.370*	−1.91	−1.624**	−2.08
Innovation Turnover	0.019***	3.45	0.007	1.12	0.008***	3.12	0.153**	2.32	0.009	1.31
Export Share	0.007*	1.65	0.005	0.60	0.015***	3.32	−0.007	−0.63	0.022*	1.96
Foreign Labour	0.007	0.60	−0.010	−0.59	0.003	0.39	−0.001	−0.08	0.041**	2.03
Control variables:										
Firm Growth	0.004	0.12	0.050	0.22	0.112	0.97	0.195	0.67	0.045	0.58
Country Dummy	Yes		Yes		Yes		Yes		Yes	
Sector Dummy	–		–		–		–		–	
• Construction										
• Wholesale & retail										
• Hotel & restaurant										
• Transp, stor & comm										

Table 2 (continued)

	Trans, storage & comm		Financial int.		Real est., rent & buss activ.		Health & soc. works		Other comm, soc. & pers. serv	
	Coef.	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*
• Financial intermed										
• Real est., renting & buss activities										
• Health & soc. works										
• Other community, soc. & personal serv.										
Log likelihood	−408		−322		−944		−309		−245	
# of obs.	454		387		1064		350		320	
LR Chi2	76		89		171		78		93	
Prob > Chi^2	0.00		0.00		0.00		0.00		0.00	
Pseudo R^2	0.09		0.12		0.08		0.11		0.16	

* $p < .1$; ** $p < .05$; *** $p < .01$ (two–tailed test); Coef. = regression coefficient; and z = z–value

Table 3 Ordered logistic regression results per country group

	Continental European		Eastern European		Scandinavian		Mediterranean		Anglo–Saxon	
	Coef.	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*	*Coef.*	*z*
Variables of interest:										
Firm Size:										
Medium–Sized Firm	0.017	0.05	−0.564**	−2.45	0.267	0.71	−0.636***	−2.11	−0.63	−0.97
Small–Sized Firm	0.025	0.07	−0.850***	−3.69	−0.049	−0.13	−1.102***	3.73	0.81	−1.26
Micro–Sized Firm	−0.320	−0.99	−0.633***	−2.86	−0.241	−0.67	−0.795***	−2.83	−1.19**	−1.97
Innovation Turnover	0.008**	2.18	0.010***	5.53	0.152***	4.38	0.005**	2.26	0.01*	1.71
Export Share	0.147***	4.35	0.007***	3.61	0.012***	3.44	0.005	1.58	0.02**	2.30
Foreign Labour	0.011***	3.62	0.015	1.21	−0.011*	−1.65	0.010*	1.77	0.02***	2.64
Control variables:										
Firm Growth	0.125	0.93	0.021	0.62	0.001	0.01	0.085	1.12	0.14	0.26
Sector Dummy										
• Construction	−0.027	−0.13	.242	1.59	−0.26	−1.13	−.059	−0.34	−.396	−0.84
• Wholesale & retail	0.312	1.53	.241*	1.82	0.175	0.84	−.130	−0.86	−.531	−1.20
• Hotel & restaurant	−0.189	−0.75	−.034	−0.19	−0.695**	−2.36	−.154	−0.72	−1.48***	−2.28
• Transp, stor & comm	0.263	0.96	.146	0.83	−0.77***	−2.59	−.187	−0.84	.039	0.07
• Financial intermed	0.562**	2.06	−.396	−1.95	−0.24	−0.78	−.031	−0.13	−1.20	−1.43
• Real est., renting & buss activities	−0.208	−0.98	.395***	2.71	−0.114	−0.47	.096	0.56	−.553	−1.20
• Health & soc. works	−0.274	−0.84	.169	0.91	−0.059	−0.19	−.143	−0.54	.197	0.24
• Other community, soc. & personal serv.	−0.605	−1.55	−.022	−0.11	−0.813	−2.15	.090	0.36	−.255	−0.28
Log likelihood	−1036		−2261		−814		−1597		−213	
# of obs	1248		2334		916		1620		343	
LR Chi^2	83.84		91.69		86.00		41.22		35.70	
Prob > Chi^2	0.00		0.00		0.00		0.00		0.00	
Pseudo R^2	0.04		0.02		0.05		0.01		0.08	

* $p < .1$; ** $p < .05$; *** $p < .01$ (two–tailed test); Coef. = regression coefficient; and z = z–value. We classify the countries as follows: Anglo–Saxon (Ireland and UK), Continental European (Belgium, Germany, France, Luxemburg, Netherlands and Austria), Eastern European (Czech Republic., Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia, Slovakia, Bulgaria and Romania), Mediterranean (Greece, Spain, Italy, Portugal, Cyprus and Malta), and Scandinavian/Nordic (Denmark, Finland, Sweden, Norway and Iceland) (Turkey is uncategorized)

Looking at the effect of EU standardization for different industries reveals differences across industries. Interestingly, we find that firm size does not matter in the *hotel & restaurant*, *transportation, storage & communication*, or *financial intermediaries* industries: None of the firm size dummy variables in these industries are statistically significant. Furthermore, the firm size dummy variables slightly matter for *manufacturing* (*Micro–Sized Firm*: −0.470, with $z < 0.10$), *real estate, renting & business activities* (*Small–Sized Firm*: −0.801, with $z < 0.10$), and *health & social works* (*Micro–Sized Firm*: −1.370, with $z < 0.10$) industries. Similarly, the firm size dummy variables are significant for the *wholesale & retail* industry (*Small–Sized Firm*: −0.699, with $z < 0.10$; and *Micro–Sized Firm*: −0.837, with $z < 0.05$). Moreover, all firm size dummy variables are statistically significant for *construction* (−1.256, with $z < 0.05$, for *Micro–Sized Firm*; −1.581, with $z < 0.05$, for *Small–Sized Firm*; and −0.821, with $z < 0.10$, for *Medium–Sized Firm*), and *other communication, social and public services* (−1.624, with $z < 0.01$, for *Micro–Sized Firm*; −1.827, with $z < 0.01$, for *Small–Sized Firm*; and −2.325, with $z < 0.01$, for *Medium–Sized Firm*) industries.

Recall that our argument as to why large enterprises are more likely to perceive benefit from EU standardization than their smaller counterparts is threefold: economies of scales in dealing with the compliance cost, better market opportunities from the single market that are related to their large portfolio of activities, and superior lobbying resources to shape the standard upfront. This logic largely applies to industries such as *construction*, *wholesale & retailing*, and *other communication, social and public services*. However, these mechanisms are not so likely to be at work in the *hotel & restaurant*, *transportation, storage & communication*, and *financial intermediaries* industries. To explain this, we suggest yet another mechanism, which we below develop and discuss briefly.

Specifically, regarding the finding that the effect of the firm size dummy variables is significant in some industries but not in others, we suggest that this might be explained by technological change and industry maturity. Industries differ in terms of their maturity and degree of harmonization, which may be independent of EU standardization efforts. Indeed, in many industries, standardization emerges over time as technology evolves and moves toward maturity (Utterback 1996; Tushman and Murmann 1998; Murmann and Frenken 2006). This "natural" process often materializes without public intervention. Technological maturity implies that the technology has reached pervasive diffusion, its characteristics being well–known by stakeholders (Nieto et al. 1998). Note that technological maturity does not mean that further progress is absent. Rather, new technology is then further developed on the basis of common platforms that have been approved by all key stakeholders. As, in this stage, the technology is widely dispersed (Beise 2004), all stakeholders have accumulated experience and knowledge as to what can and cannot be done with this technology.

Accordingly, in such mature industries, stakeholders can potentially benefit much from network effects (Grübler et al. 1999; Egyedi and Sherif 2008). Stakeholders therefore have an incentive to negotiate about how to resolve difficulties related to technical bottlenecks by harmonizing products via standardization, from which they all gain equally through common network effects. A clear example of an industry experiencing such global harmonization of a mature technology is *financial intermediaries*. This industry is fully compatible as a result of a series of standardizations introduced to facilitate banking transactions of costumers between banks within and

across countries (see, e.g., Bátiz and Wood 2002). In that case, the internal need for harmonization precedes the external EU standardization efforts. Accordingly, compliance costs to EU standards in mature industries are expected to be lower for both large and small ventures, as all firms already operate global standards.

Moreover, in accordance with the technological regime literature, small firms compete more easily with their larger counterparts within emerging industries, while large firms develop advantages linked to concentration and increasing capital-intensity within mature industries (Malerba and Orsenigo 1997; Tavassoli 2015). The above argument that all firms already operate global standards can explain the absence of a significant firm size effect in those mature industries, while the latter cannot. Unfortunately, our dataset does not allow to test the above arguments. To be able to do so, we have to extend the estimated models with, in particular, variables catching industry maturity and technological advance (e.g., R&D expenditures[1] or patent density). As this information is not available in our dataset, we must leave this issue for future research.

Besides, our results in Table 3 indicate that the effect of firm size is not similar for all European countries. We find that firm size dummy variables do not matter at all in affecting the perceived benefit of standardization in Continental European and Scandinavian countries, and have little influence for *Micro–Sized Firm* (*−1.19,* with $z < 0.05$) in Anglo–Saxon countries. In contrast, the impact of firm size is significantly negative in Eastern European and Mediterranean countries: the coefficient is −0.564 ($z < 0.05$) for *Medium–Sized Firm*, −0.850 ($z < 001$) for *Small–Sized Firm* and −0.633 ($z < 0.01$) for *Micro–Sized Firm* in Eastern European countries, and −0.636 ($z < 0.05$) for *Medium–Sized Firm*, −1.102 ($z < 0.01$) for *Small–Sized Firm* and −0.795 ($z < 0.05$) for *Micro–Sized Firm* in Mediterranean countries. This set of findings suggests that small enterprises are less likely to perceive benefits from standardization than their large counterparts in Eastern European and Mediterranean countries. Apparently, EU standardization is more likely to be experienced as a struggle by small firms in countries from these parts of Europe. Next to economies of scale disadvantages, small firm ventures in Eastern and Mediterranean countries may well be (much) less developed than what is implied by European standards. If this is the case, then the adoption costs are very large for firms in these countries, compared to their counterparts in Continental European, Scandinavian or Anglo–Saxon countries. Likewise, in Continental European and Scandinavian countries, where earlier national standards were close to the newly–set EU standards, compliance costs are low for both large and small companies, as these already operated with such standards, which might explain the absence of a significant effect in these regions of Europe. In all, *Hypothesis 1* is partly confirmed.

As to *Hypothesis 2*, we find strong evidence supporting the argument that innovative, exporting and foreign labour–employing firms are more likely to perceive benefit from EU standardization than their non–innovative, non–exporting and non–foreign labour–employing counterparts, respectively. Indeed, the general model including all observations reveals that *Innovation Turnover* (0.008, with $z < 0.01$), *Export Share* (0.008 with $z < 0.01$) and *Foreign Labor* (0.009 with $z < 0.01$) are all significantly and positively associated with *Standardization Benefit*. The result for each industry is

[1] See, for example, though on a different question, Bos et al. (2013) who provide innovation patterns for 21 manufacturing industries in six EU countries by using a flexible measure for industry for the period 1980–1997.

almost parallel to the general model, with the exception of a few industries (see Table 2). Furthermore, we find similar results as to the effect of the *Innovation Turnover*, *Export Share* and *Foreign Labor* variables for the countries in the different regions (see Table 3). Our evidence suggests that enterprises having such technological, experience and learning capabilities are more likely to perceive benefit from EU standardization, which provides support for *Hypothesis 2*.

5 Conclusion and policy implications

Gaining more insight into the impact of standardization is important as EU regulations experience what is sometimes referred to as a "deficit of credibility" (Majone 2000; Gehring and Kerler 2008). Indeed, trust in a newly–set standard should enhance economic and welfare development as European enterprises then benefit from both standardization and reduced market failures (den Butter and Hudson 2009). In contrast, a lack of legitimacy jeopardizes the overall integration goal behind the standardization process. Particularly, the danger is that the "harmonization of policies can be harmful when local economies are diverging too much" (Jamet 2011: 563). By controlling for industry and region, our firm–level study provides quantitative evidence about the firm characteristics and capabilities that would facilitate EU standard compliance throughout the common market territory. The current study shows that EU standardization is not persistently and equally beneficially considered by all enterprises in all industries in all European countries. This contradicts the widespread belief that standardization is always beneficial (e.g., European Commission 2012) and would be as such perceived. Especially, we find that ventures of micro–small–medium size are less likely to perceive benefit from EU standardization than their larger counterparts, in particular in the *construction*, *wholesale & retail*, and *other communication, social and personal services* industries, and in Eastern European and Mediterranean countries. Additionally, we find that innovative, exporting and foreign labor–employing companies are more likely to selfreport gain from standardization than their non–innovative, non–exporting and non–foreign labor–employing counterparts.

Of course, our study is not without limitations, pointing to promising avenues for future research. Here, we would like to emphasize three such avenues. First, our study is about the relative and perceived impact of EU standardization. Due to the nature of our survey data, we could not conclude anything as to the absolute and actual benefits of EU standardization for specific types of firms and / or certain regions within Europe. Second, and likewise, our data cannot distinguish between the impact of different types of standardization, although the standardization effect may well differ across such types (e.g., Frakes 2013; Dawes 1999). For instance, minimal admissible attributes standardization may especially impact lagging enterprises from Eastern Europe, which might much less be the case for product compatibility standardization, ceteris paribus. Finally, as standards continuously evolve and are rendered obsolete by competing technologies (Kasemir et al. 2000), further research might focus on the dynamic aspect of the impact of standardization.

Overall, our findings provide additional insights as to the impact of standardization, suggesting that standardization is not only a cost or an institutional constraint, but also opens a set of opportunities for leveraging a firm's capabilities (Oliver and Holzinger

2008), such as those associated with innovation and internationalization, in the larger (integrated) European market. We must conclude that not all enterprises see gain in EU standardization. Particularly our finding that the perceived benefit of standardization is not equally distributed across firms, industries and countries is of interest for the stakeholders in the EU's standardization processes, such as national governments, business associations and the European Commission. Key is that in order to accelerate the standardization program and its integration objective, smaller ventures, particularly from Eastern European and Mediterranean countries, to develop the capabilities needed to reap the benefits from EU standardization. We suggest the use of policy instruments that are tailored at supporting the identified capabilities: innovation performance, export experience and international workforce. Furthermore, stimulation efforts could be considered to address simultaneously supporting capabilities and standardization literacy.

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